

# MILK PRODUCTION POTENTIAL AND KEEPING QUALITY OF CAMEL MILK

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## ABSTRACT

Daily milk production in 5 lactating camels each of Bikaneri, Jaisalmeri and Kachchhi breeds belonging to first, second and third parity was studied. Milk yield was recorded daily at 12h intervals by 2 different milking techniques, viz. 4-teat stripping and 2-teat stripping of one side and allowing the calf to suckle the other 2-teats. The average daily milk production by 4-teat and 2-teat stripping were  $2.80 \pm 0.17$  and  $3.98 \pm 0.32$  l/day in Bikaneri,  $2.60 \pm 0.17$  and  $3.90 \pm 0.34$  l/day in Jaisalmeri and  $3.04 \pm 0.17$  and  $4.12 \pm 0.35$  l/day in Kachchhi, respectively. The effect of breed was significant ( $p < 0.05$ ) for total milk production in 4-teat stripping. The effect of parity was also significant ( $p < 0.01$ ) for total production under both the milking techniques. The month-wise daily milk production under both the techniques indicated significant ( $p < 0.01$ ) variation. Keeping quality was studied in 50 fresh camel milk samples comprising of pure and milk diluted with water (1:1) kept at room temperature ( $29 \pm 3^\circ\text{C}$ ); pure and diluted (1:1) milk stored at  $4^\circ\text{C}$ . The parameters studied at 2h intervals were acidity, clot on boiling (COB) test, alcohol test, alizarin-alcohol test and pH. The study indicated that pure and diluted (1:1) milk at room temperature could be stored for 8 and 10h, respectively, while pure and diluted (1:1) milk at  $4^\circ\text{C}$  can be stored for 20 and 28 days, respectively.

**Key words:** Camels, keeping quality, milk production potential

Camels milk for a longer period of time than milk of any other animals held under the same conditions. In Kenya, camel produces 8-10 kg/day and cow 5-6 kg/day milk (Karne, 1998). In U.A.E. camels lactate up to 16-18 months with a highest average milk yield during the first 6 months (Wernery *et al*, 2004). In East Africa, where 60% of the world camel population exists, the consumption of camel milk is not limited to pastoral nomads, but it is also sold in the urban areas. However, in India camel milk is mainly utilised by the traditional camel keepers (Raikas/Rabaris). Camel milk and milk products are gaining an escalated popularity and acceptance for human consumption (Wernery, 2006). An increasing camel milk production in many countries of the world shows possible successful marketing of camel milk and milk products. Camel milk production in Rajasthan is affected by feed scarcity, restricted movement, health problems, low income of camel breeders and lack of milking hygiene (Archibald Albrecht, 2006). The present study is an attempt to investigate the production and keeping quality of camel milk.

## Materials and Methods

Milk production in 5 lactating camels each of Bikaneri, Jaisalmeri and Kachchhi breeds belonging

to first, second and third parity was recorded. Milk yield was recorded at 12h interval daily in the dams from 5<sup>th</sup> to 16<sup>th</sup> months of lactation. The calves were allowed to suckle the dams for the first 4 month of lactation. Two milking techniques, i.e. simultaneous milking of 4 teats by hand stripping and two-teat milking of one side, allowing calf to suckle the other two teats for better let-down were adopted. The data were analysed through least-squares maximum likelihood method (Harvey, 1987).

A total of 50 fresh samples were collected and keeping quality was studied for pure camel milk, milk diluted with water (1:1) at room temperature  $29 \pm 3^\circ\text{C}$  (the day temperature during the experimental period varied from  $26-32^\circ\text{C}$  and between  $10-16^\circ\text{C}$  at night); pure and diluted (1:1) milk stored at  $4^\circ\text{C}$ . The pH value of milk samples was measured using an electronic pH meter (Systronic pH System 361). Acidity was measured as per AOAC (1980); Acidity was reported as % lactic acid by weight (1ml 0.1N NaOH = 0.0090 g lactic acid). Other parameters viz. clot on boiling (COB); alcohol and alizarin-alcohol tests were studied as per Singh (1992). All parameters were studied at 2h intervals. The data were statistically analysed (Snedecor and Cochran, 1994).

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## Results and Discussion

Breed, parity and month-wise least-squares means of daily milk production (L/day) with different milking techniques are presented in Table 1 and Fig 1. The average daily milk production was found to be higher in Kachchhi camels followed by Bikaneri and Jaisalmeri camels. The total daily milk production was higher with 2-teat compared to 4-teat stripping. The effect of breed was significant ( $p < 0.05$ ) for total milk production in 4-teat stripping. Highest daily milk production was previously reported in Kachchhi followed by Bikaneri and Jaisalmeri breeds (Sahani *et al*, 1998). Highest daily milk production was noticed for parity III animals followed by parity I and II. The effect of parity was significant ( $p < 0.01$ ) for total production under both the milking techniques. Sahani *et al* (1998) also reported significant contribution of parity under 2-teat and 4-teat milking and parity III camels produced more milk as to parity II. The average daily milk production by 2 and 4-teat stripping was highest

**Table 1.** Breed, parity and month-wise least-squares mean of daily milk production (L/day) with different milking techniques in lactating camels.

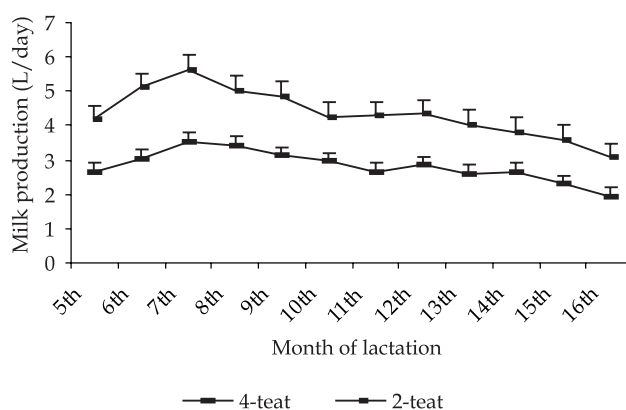
	Milking techniques	
	4-teat	2-teat
<i>Breed</i>	*	
Bikaneri	2.80±0.17(58)	3.98±0.32(58)
Jaisalmeri	2.60±0.17(60)	3.90±0.34(60)
Kachchhi	3.04±0.17(60)	4.12±0.35(60)
<i>Parity</i>	**	**
I	2.19±0.13(49)	2.82±0.20(49)
II	1.96±0.26(12)	2.62±0.38(12)
III	3.07±0.08(117)	4.32±0.18(117)
<i>Month</i>	**	**
5 <sup>th</sup>	2.66±0.25(15)	4.18±0.39(15)
6 <sup>th</sup>	3.05±0.24(15)	5.13±0.38(15)
7 <sup>th</sup>	3.51±0.27(15)	5.62±0.42(15)
8 <sup>th</sup>	3.42±0.25(15)	5.04±0.42(15)
9 <sup>th</sup>	3.13±0.25(15)	4.85±0.42(15)
10 <sup>th</sup>	2.97±0.25(15)	4.26±0.43(15)
11 <sup>th</sup>	2.67±0.24(15)	4.28±0.42(15)
12 <sup>th</sup>	2.86±0.25(15)	4.33±0.42(15)
13 <sup>th</sup>	2.60±0.25(15)	4.04±0.42(15)
14 <sup>th</sup>	2.65±0.25(13)	3.82±0.42(13)
15 <sup>th</sup>	2.30±0.25(15)	3.60±0.41(15)
16 <sup>th</sup>	1.93±0.26(13)	3.06±0.43(14)

\*\*  $p < 0.01$ ; \*  $p < 0.05$

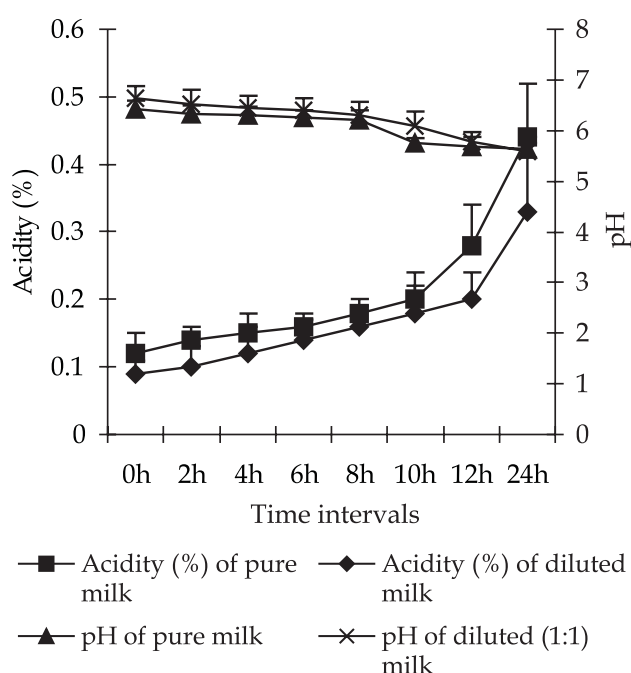
Figures in the parenthesis indicate the number of observations

during month 7 of lactation (Fig 1). The month-wise daily milk production under both the techniques indicated significant ( $p < 0.01$ ) variation. Sahani *et al* (1998) reported highest milk production during sixth month of lactation in Indian camels and Gailli *et al* (2000) reported highest milk production during fourth month of lactation in Saudi camels. The higher milk yield with 2-teat stripping and allowing calf to suckle compared to 4-teat milking has been reported by Simpkin (1994) and Sahani *et al* (1998) and might be due to better let-down.

Keeping quality of pure camel milk stored at room temperature is presented in Table 2 and Fig 2. A significant ( $p < 0.05$ ) increase in acidity was observed after 8h. COB test remained negative for 8h and after



**Fig 1.** Month-wise least-squares means of daily milk production (l/day) with different milking technique in lactating camels.



**Fig 2.** Changes in pH and acidity(%) of pure and diluted (1:1) camel milk.

**Table 2.** Keeping quality of pure camel milk stored at room temperature (29±3°C).

Parameters	0h	2h	4h	6h	8h	10h	12h	24h
Acidity(%)	0.12±0.03	0.14±0.02	0.15±0.03	0.16±0.02	0.18*±0.02	0.20*±0.04	0.28*±0.06	0.44**±0.08
COB test	-ve	-ve	-ve	-ve	-ve	+ve	+ve	+ve
Alcohol test	-ve	-ve	-ve	-ve	-ve	+ve (flake)	+ve	+ve
Alizarin alcohol test	Brown red	Brown red	Brown red	Brown red	Brown red	Reddish brown	Yellowish brown	Brownish yellow
pH	6.42±0.18	6.34±0.15	6.30±0.16	6.25±0.16	6.20±0.19	5.75**±0.10	5.69**±0.18	5.63**±0.25

\*\* indicates significance at p<0.01 in comparison to 0h \* indicates significance at p<0.05 in comparison to 0h

**Table 3.** Keeping quality of diluted camel milk with water (1:1) at room temperature (29±3°C).

Parameters	0h	2h	4h	6h	8h	10h	12h	24h
Acidity(%)	0.09±0.02	0.10±0.03	0.12±0.04	0.14±0.03	0.16*±0.03	0.18*±0.04	0.20*±0.04	0.33**±0.08
COB test	-ve	-ve	-ve	-ve	-ve	-ve	+ve	+ve
Alcohol test	-ve	-ve	-ve	-ve	-ve	-ve	+ve	+ve
Alizarin alcohol test	Brown red	Brown red	Brown red	Brown red	Brown red	Brown red	Reddish brown	Brownish yellow
pH	6.65±0.22	6.53±0.28	6.45±0.24	6.40±0.25	6.30±0.27	6.10±0.28	5.78**±0.18	5.60**±0.16

\*\* indicates significance at p<0.01 in comparison to 0h \* indicates significance at p<0.05 in comparison to 0h

that it becomes positive along with flakes formation. Alizarin-alcohol test also confirmed that camel milk becomes unfit after 8 hours. A significant (p<0.01) decrease in pH was observed after 10h.

Keeping quality of milk-diluted with water (1:1) is presented in Table 3 and Fig 2. The change in acidity was found to be significant (p<0.05) after 8h. COB and alcohol tests were found negative up to 10h and after that these became positive. There was a significant (p<0.01) decrease in pH after 12h.

Acidity and pH of the pure fresh milk before keeping at 4°C were 0.10±0.01 per cent and 6.50±0.12, respectively and other parameters viz. COB, alcohol and alizarin alcohol tests were found to be negative. Acidity and pH of the milk were 0.18±0.03 per cent and 6.20±0.18, respectively at the end of 20 days and other parameters were also found to be positive. Acidity and pH of the diluted fresh milk (1:1) before keeping at 4°C were 0.09±0.03 per cent and 6.60±0.15, respectively and no changes were observed for COB, alcohol and alizarin alcohol tests. Acidity and pH of the milk was 0.17±0.03 per cent and 6.06±0.12, respectively at the end of 28 days and other parameters were also found to be positive.

The standard for raw camel milk offered for sale in Saudi Arabia requires total acidity to be less than 0.18% (Saudi Arabia Standards Institution, 1978). In fresh Bedouin camel milk samples pH was found to range between 6.1-6.8 (Guliye *et al*, 2000). Camel milk sours slowly and change in pH was not observed when kept at 30°C for 5 days or at 4°C for 3 months

(Yagil *et al*, 1984). Camel milk sours in 8h at 30°C compared to 3h for cow milk at the same temperature (Ohri and Joshi, 1961). These findings clearly reflect that Indian camel breeds possess milk production potential and have significant contribution of various factors such as stage of lactation, breed, parity and stage of milking. The lactation period could last for 16 months.

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